Lidar depolarization ratio of soot fractal aggregates: spectral dependence over the visible-to-infrared spectrum

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The global warming and environmental issues imply the study of anthropogenic airborne particulate matter (PM), such as carbonaceous or soot aerosols, emitted by several sources. Carbonaceous particulate matter emitted by aircraft engines is due to incomplete fuel combustion. These particles can have long residence times in the upper troposphere and lower stratosphere and affects the global radiative budget. Soot particles are considered to influence ice and liquid water cloud droplet activation as they could be important centers of ice-particle nucleation and would promote ice formation involved in contrails formation for instance. The understanding of ice-forming activity of soot particles is closely related to the knowledge of their microphysical properties. The primary soot particles, with size distribution in the nanoscale range, form large and robust complex-shaped cluster of particles such as fractal aggregates. Lidar measurements are useful in deriving the radiative properties of scattering media from backscattered light at several wavelengths. Polarization-sensitive lidar measures the total lidar depolarization ratio which can be separated into the molecular and aerosol depolarization ratio. The determination of the latter over the visible-to-infrared spectrum is expected to improve the determination of aerosol types present in the atmosphere. We propose to study the spectral dependence of lidar depolarization ratio for several soot fractal aggregates generated by diffusion-limited cluster-aggregation (DLCA). Our Spectral Discrete Dipole Approximation (SDDA) [1,2] model is used to accurately simulate the lidar depolarization ratio over the visible-to-infrared spectrum. Results from the SDDA method will be presented and compared with the lidar depolarization ratio measured by our instruments.

References

[1] R. Ceolato, M. J. Berg, and N. Riviere, 2013: Spectral and angular light-scattering from silica fractal aggregates. *J. Quant. Spectrosc. Radiat. Transfer* **131**, 160–165.

[2] R. Ceolato, F. Gaudfrin, O. Pujol, N. Riviere, M. J. Berg, and C. M. Sorensen, Lidar cross-sections of soot fractal aggregates: assessment of equivalent-sphere models. *J. Quant. Spectrosc. Radiat. Transfer*, in press.

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